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# The genus *Schismatoglottis* Zoll. & Moritzi (*Araceae : Schismatoglottideae*) in Peninsular Malaysia and Singapore

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**Summary.** The species of *Schismatoglottis* Zoll. & Moritzi in Peninsular Malaysia and Singapore are enumerated, keyed and illustrated. Seven species are recognized; in addition, *S. penangensis* Engl. is left as a *species dubia*. *S. cordifolia* Ridl. is reduced to the synonymy of *S. calyptrata* (Roxb.) Zoll. & Moritzi; *S. minor* Hook.*f.* is a synonym of *S. brevipes* Hook.*f.*; *S. ridleyana* Engl. and *S. linguiformis* Engl. are synonyms of *S. mutata* Hook.*f.*; *S. kingii* Engl. and *S. marginata* Ridl. (non Engl.) are synonyms of *S. scortechinii* Hook.*f.* No new species are proposed. Biogeography, shoot architecture, morphology, phenology, dispersal and infrageneric taxonomy are briefly discussed.

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*Schismatoglottis* Zoll. & Moritzi (including the Malesian *Apoballis* Schott and *Colobogynium* Schott and the Neotropical *Philonotion* Schott) is a genus of over 100 species of generally diminutive herbs, sometimes rheophytes, in lowland and lower montane rain forests. The genus is centred on Borneo where the greatest diversity and greatest concentration of species occurs; its full range is from tropical southwestern China and Indochina to Malesia east to Vanuatu and a disjunct occurrence of three species in the Neotropics (Bunting 1960, Bunting & Steyermark 1969). The neotropical representation is yet to be subjected to critical re-evaluation, but it does at least appear that these species belong to the same tribe, Schismatoglottideae Nakai (*sensu* Grayum 1990). The remaining, much smaller, genera of the tribe—*Aridarum* Ridl., *Bucephalandra* Schott (incl. *Microcasia* Becc.), *Heteroaridarum* M. Hotta, *Hottarum* Bogner & Nicolson, *Phymatarum* M. Hotta and *Piptospatha* N.E. Br. (incl. *Gamogyne* N.E. Br., *Rhynchopyle* Engl.)—are all endemic to Borneo with the exception of *Piptospatha* which also occurs on the Malay Peninsula and in Thailand. There is thus a spectacular geographical disjunction at least at tribal level across the Pacific. Other amphi-Pacific genera of Araceae are known, including *Arisaema*, *Homalomena* and *Spathiphyllum*, though each has a somewhat different pattern:

*Arisaema*, a predominantly temperate to subtropical genus, is thought to have migrated from Asia relatively recently along land bridges across the Bering Strait (Grayum 1990). Tropical *Spathiphyllum* is predominantly neotropical and its Old World representation is in Wallacea and to the east. *Homalomena* has a pattern more similar to that of *Schismatoglottis*: centred on Malesia with a few neotropical species but differing from the latter genus in a fairly strong representation in New Guinea and representation (though poor) in India. That may sugggest a Gondwanan pattern, though species limits and relationships in *Homalomena* are not yet well enough understood for firm biogeographic interpretations to be made. *Schismatoglottis,* on the other hand, is very poorly represented in New Guinea and absent from the Indian subcontinent altogether. Thus the remarkable aspect of the tropical transpacific distribution of *Schismatoglottis* is that it does not appear readily explicable as a relict Gondwanan one.

Taxonomic studies have been made on several of the smaller genera of the Schismatoglottideae fairly recently (Bogner 1978, 1980; Hotta 1965, 1976; together with *ad hoc* descriptions of new species—see Hay *et al.* 1995a & b), but *Schismatoglottis* has not been reviewed since the monograph by Engler & Krause (1912) in spite of the addition of many new species, mainly by Alderwerelt van Rosenburgh (1922a,b) and Hotta (1966). The allied genera mentioned here have been maintained by Mayo, Bogner & Boyce (in press), however it is a moot point whether all of these can be kept separate from *Schismatoglottis* as it is possible that *Schismatoglottis* is paraphyletic in relation to them and, if this is demonstrated, it may (or indeed may not) be desirable to reflect that status with changes in nomenclature. Moreover, phenetically, distinction from *Piptospatha* seems reduced to a single character (spathe constriction) in the case of *Schismatoglottis roseospatha* Bogner (Sarawak) and others.

## Some morphological notes

A considerable degree of variation in shoot architecture is exhibited by *Schismatoglottis*, with Peninsular Malaysian species falling broadly into two categories. The following observations are made from plants in cultivation.

The commonest and most widely distributed species in the genus, *S. calyptrata* and many (but not all) immediately allied species have hapaxanthic shoots. The majority of (non-climbing) aroids conform more or less closely to Chamberlain's architectural model (*sensu* Hallé & Oldeman, 1970) in which physiognomically unbranched shoots consist of a series of terminally flowering orthotropic modules with shoot growth being renewed by a single relay axis incepted typically in the axil of the penultimate leaf or leaf homologue below the inflorescence (or the last inflorescence in a synflorescence) (Fig. 1a). In *S. calyptrata* and *S. wallichii* it appears that the relay axis aborts (Fig. 1b), so that the shoot dies after fruiting. However, there is a sympodial rhizome system by which the plant perennates, so that these

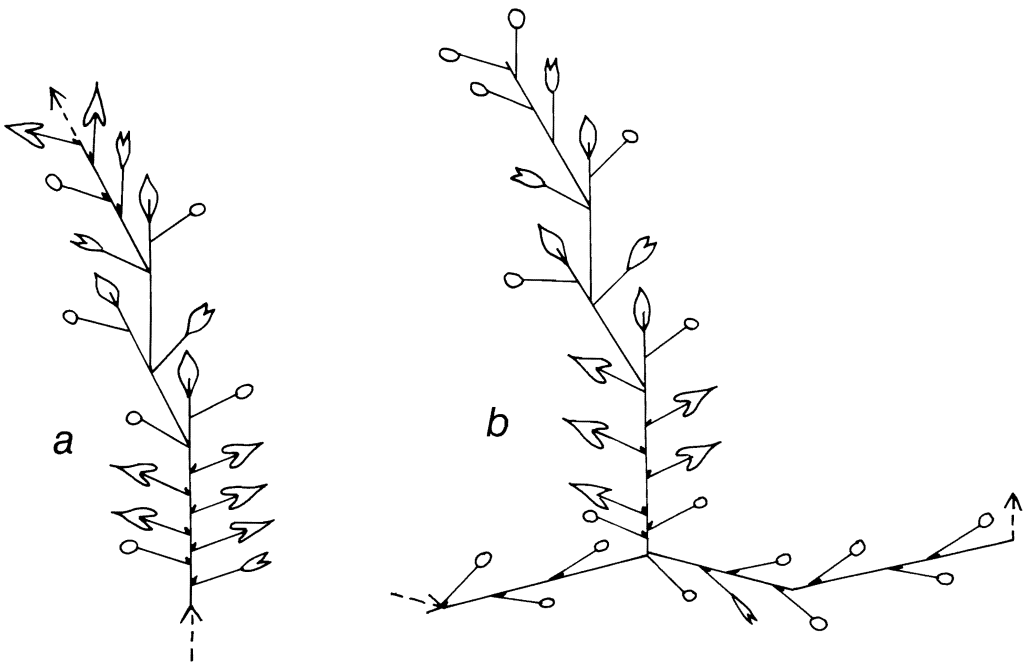


**Fig. 1.** Schematic representation of shoot organisation in Peninsular Malaysian *Schismatoglottis*: **a.** *S. mutata*, with renewal growth after flowering (top), and hence a pleonanthic shoot; **b.** *S. wallichii* showing an abortive renewal axis after flowering (top), hence a hapaxanthic shoot but with a new shoot developing from a stolon developing laterally from the base of the previous axis. = prophyll; = cataphyll; = foliage leaf; = inflorescence; = axillary bud with potential for reiteration; = repeated pattern of organisation.

species represent an herbaceous manifestation of Tomlinson's model which does not appear to have been recorded hitherto for the Araceae. The vegetative stems of these species are hypogeal. The seedling shoot, once flowering size, may bear a number of close-spaced side shoots and hence be clump-forming, or the side shoots may begin as stolons which eventually terminate in a leafy and ultimately flowering shoot and hence the plant is colony-forming. Other species evidently conform to Chamberlain's model and develop an aerial decumbent to erect stem which branches laterally (reiterating the underlying pattern) in varying degree. In *S. brevicuspis* lateral branches occasionally flower without the production of foliage leaves, giving the appearance of lateral inflorescences subtended by cataphylls.

The leaf sheath in *Schismatoglottis* presents some taxonomically useful variation. In *S. mutata* and *S. brevipes* the wings of the sheath (and the inflorescence bracts) are deliquescent to marcescent. These are persistent in other Peninsular species. In a number of Bornean species other modifications of the leaf sheath occur, such as free-ligular sheaths (e.g., *S. multiflora* Ridl.; also cf. *Piptospatha* and other related genera), or sheaths which are

much reduced in length and whose function of encasing developing leaves is taken over by cataphylls interposed between the foliage leaves (e.g., *S. tecturata* (Schott) Engl.).

Many *Schismatoglottis* species have individuals with variegated leaves, though variegation is apparently entirely absent from certain species or species groups, e.g., *S. brevipes*, *S. mutata*, *S. longifolia* and *S. brevicuspis*. In not a few instances variegated individuals have been recognized formally at the level of variety or forma. This is not continued, as it seems to serve no valuable purpose botanically, though some cultivated forms might be recognized at the rank of cultivar. Though some Peninsular species are highly ornamental and have considerable horticultural potential (e.g., forms of *S. wallichii* and *S. scortechinii*), the genetics of variegation in *Schismatoglottis* does not seem to have been investigated at all. However, there seem to be three parameters of variation: colour, intensity of colour and horizontal distribution of coloured patches. Two colour classes are yellow-green and grey-green. Distribution occurs as irregularly distributed spots and splotches, a central stripe, a stripe on each side of the lamina about midway between the midrib and the margin, a central stripe and two lateral stripes. Spotted and striped patterns are sometimes superimposed in instances where stripes are manifested as aggregations of spots. These patterns are either grey-green or yellow-green, but they may be intense or faint. In rare instances (observed by me only in an unidentified species in Sabah) variegation involves three shades in one leaf perhaps depending on the number of cell layers in which full expression of chlorophyll has been inhibited; in such a case the ground colour is dark green, and the leaf is spotted mid-green and grey green. Species in which variegation does occur generally show several patterns (in different individuals) which remain constant over time. It is interesting that quite distantly related species may show the same or at least much overlapping sets of variegants, suggesting homologous variation or an homologous propensity to vary in this respect. The biological significance of variegation in *Schismatoglottis* is unknown.

Several Peninsular species have an indumentum on the petioles and abaxial sides of the midrib with variation within species in the density. *S. mutata* and *S. brevipes* both have minute velvety hairs not individually discernible with the naked eye but which, where dense, give a velvety aura to the leaf stalks. Minute multicellular emergences give the petioles of *S. scortechinii* an asperous feel. In Borneo species occur with conspicuous multicellular trichomes on the stems, leaves and spathes (e.g., *S. barbata* Engl., *S. ferruginea* Merr.).

Though the inflorescences in *Schismatoglottis* are often quite inconspicuous, they are of intricate and complex structure. The spathe is divided into upper and lower parts delineated from one another by a more or less pronounced constriction and a change in texture, colour and behaviour. The lower spathe encases the female flowers and the developing fruits, and is persistent and green, growing somewhat after flowering as the fruits develop and eventually longitudinally dehiscent from the base as the fruits ripen. The upper spathe, or limb, is more membranous, and exhibits a range of shapes and differing behaviour at and

after anthesis. The generic name alludes to the condition in *S. calyptrata* and *S. wallichii* where immediately after female anthesis the living spathe limb is abruptly abscised at the constriction leaving the distal portion of the spadix exposed during male anthesis and persistent for some time after, finally rotting. Up until that point the limb has been much inflated during female anthesis, gaping ventrally or with the margins loosely overlapping. In *S. longifolia*, *S. mutata*, *S. brevipes* and *S. brevicuspis* the spathe limb is narrowly lanceolate, loosening (together with the lower spathe) at female anthesis and barely open at male; thereafter the limb closes again and perists for some time before rather gradually senescing, eventually becoming deciduous at the level of the constriction together with the by now redundant male and sterile parts of the spadix. A somewhat intermediate state is exhibited by *S. scortechinii* in which the limb opens cowl-like at anthesis and then rapidly senesces (becoming a dirty dark grey colour) and falls away; during senescence the living portions of the spathe limb become first crumbly and brittle and the limb may be dislodged before senescence is complete.

The spadix (see Fig. 2) in *Schismatoglottis* consists of a lower female zone, a middle male zone and a terminal sterile appendix (as is commonly the case in monoecious aroids, e.g., *Alocasia, Typhonium, Arisaema*—though in many instances the appendix is absent, e.g., *Homalomena, Furtadoa, Cryptocoryne, Aglaonema*). The female zone consists of naked pistils usually interspersed with staminodes occurring in much smaller numbers than the pistils (cf. *Homalomena* where, when staminodes are present, one accompanies each ovary). These are referred to here as interpistillar staminodes. Frequently interpistillar staminodes are also concentrated in a ring at the base of the female zone. In species such as *S. brevicuspis*, staminodes of this type may actually be absent from amongst the pistils and confined to a basal ring, but their shape (stalked with the apex expanded) and colour (usually white) suggest that they are homologous to interpistillar staminodes in other species. The appendix is also composed of structures conventionally called staminodes, but their form (mostly columnar) and differing colour suggest that they are not fully homologous with the staminodes of the female zone. Either or both types of staminode may also make up a sterile interstice between the male and female zones, though this is more or less absent in some species, e.g., *S. calyptrata*. *Schismatoglottis wallichii* is remarkable in having a very long interzonal sterile zone composed of appendical staminodes, and the appendix *per se* absent, suggesting that the male zone and appendix may have "exchanged positions" on the spadix. The rather complex situation in *S. scortechinii* is discussed under that species. The male zone in *Schismatoglottis* consists of massed stamens which are generally not aggregated into any pattern able to be equated with male "flowers", though in *S. longifolia* and *S. scortechinii* there is irregular grouping into twos and threes which may suggest some residual homology to "flowers" in the male zone which has been lost in other species. Elsewhere in the range, other species occur in which male "flowers" are discernible (Hotta 1993). Pollen is generally extruded through apical pores in the truncate stamens, and is generally dusty, though in *S. scortechinii* the grains adhere in very slender filaments.

Ripe fruiting spadices are rarely encountered in *Schismatoglottis*, probably due to the

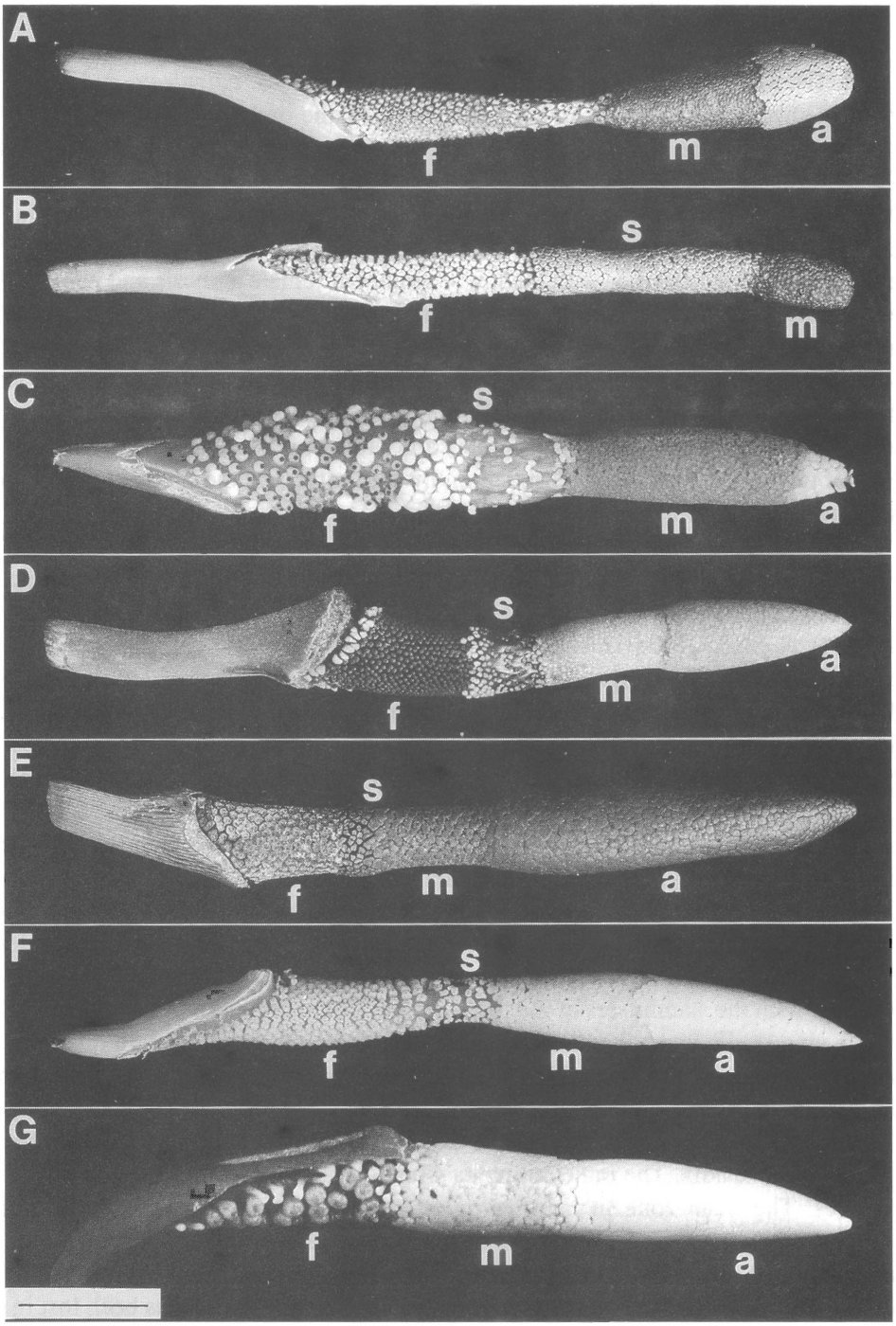


**Fig. 2.** Spadices of *Schismatoglottis* (not to same scale). **A.** *S. calyptrata* (HRBS Acc. no. 940125). **B.** *S. wallichii* (HRBS Acc. no. 940354). **C.** *S. brevipes* (HRBS Acc. no. 940198). **D.** *S. mutata* (HRBS Acc. no. 940142); the slightly ovoid appendix is not typical: see text. **E.** *S. scortechinii* (HRBS Acc. no. 940325). **F.** *S. brevicuspis* (HRBS Acc. no. 940084). **G.** *S. longifolia* (HRBS Acc. no. 940121). f = female zone; s = interzonal staminodial region; m = male zone; a = appendix. Scale bar: to A = 1.44 cm; to B = 1.77 cm; to C = 0.91 cm; to D = 1.65 cm; to E = 1.5 cm; to F = 1.36 cm; to G = 0.72 cm.

apparently rapid transition from almost ripe infructescence to disintegration. As noted above the fruiting spathe is dehiscent from the base (where known). The fruits are small (*c.* 2–3 mm diam.), greenish, odourless and contain several to numerous minute somewhat sticky seeds. As yet there are no observations that might suggest a dispersal mechanism, and none able to account for the enormous range of *S. calyptrata* (*q.v.*) in terms of long-distance dispersal.

In the Malay Peninsula, *Schismatoglottis* is confusable with other terrestrial herbaceous genera which have striate leaf venation. Among these are *Homalomena* from which it differs in not being aromatic and in the caducous or deliquescent/deciduous spathe limb and the appendix (this sometimes also absent or much reduced in *S. wallichii*, as noted above) and in the lack of definable male flowers in the male zone. Confusion may also occur with *Furtadoa*, which is much like an elliptic-leaved *Homalomena* with pistillodes in the male flowers, and with *Piptospatha*, which has free-ligulate leaf sheaths and is rheophytic (*Schismatoglottis* may also be like this in East but not Peninsular Malaysia, and in other parts of its range). It is distinguished from *Aglaonema* by differentiation of the spathe into upper and lower parts separated by a constriction, the presence of interpistillar staminodes and/or an appendix, the much larger number of smaller pistils and the much smaller fruits. These distinguishing features are summarised in the key below.

**Key to striate-veined herbaceous aroid genera in the Malay Peninsula**

1. Colonial in tidal mud. ..... *Aglaodorum*
   Not so. ..... 2

2. Leaf sheath free for most of its length, ligulate. ..... *Piptospatha*
   Leaf sheath fully attached (except distal few mm). ..... 3

3. Stems and leaves aromatic when crushed. ..... 4
   Stems and leaves not aromatic. ..... 5

4. Female flowers with staminodes; male flowers with pistillodes. ..... *Furtadoa*
   Female flowers usually with staminodes; male flowers never with pistillodes ..... *Homalomena*

5. Spathe not constricted. ..... 6
   Spathe constricted. ..... 7

6. Male zone with clearly definable male flowers; inflorescence more or less nodding (ventral side down) after anthesis; interpistillar staminodes usually present; fruit small (mm), green ..... *Homalomena*

Male zone a mass of stamens; inflorescence more or less supine (ventral side up) after anthesis; interpistillar staminodes absent; fruit large (cm), red ..... *Aglaonema*

7. Spathe fully persistent after anthesis; male zone with clearly definable male flowers ..... *Homalomena*
   Spathe limb caducous or rotting; male zone a mass of stamens ..... ..... *Schismatoglottis*

## A note on cited collections

Plants seen in the field by the author in January 1994 (Hay *et al.* 9000–9297) were mostly sterile. Living plants were collected (without vouchers in sterile instances) for the purpose of preparing herbarium material after flowering in cultivation at the Royal Botanic Gardens Sydney. Spirit material and dried specimens are being accumulated from these plants, and will be distributed to herbaria at K, KEP and UPM and other herbaria where surplus material allows, in due course. Where species are widespread and common and have been gathered by many collectors, a small representative sample of specimens has been cited, as a full listing seems superfluous. However, I have cited my own collections fully, since they, as living plants, have been the main source of data from which the descriptions presented here have been compiled.

Lectotype specimens selected here have been chosen on the basis of their being the most complete and/or most widely distributed extant of the syntypes, unless some other explanation is given.

## Systematic enumeration

*SCHISMATOGLOTTIS* Zoll. & Moritzi, Syst. Verz. (1846) 83; Schott, Prodr. Syst. Aroid. (1860) 320; Engl. in DC., Monogr. Phan. 2 (1879) 349; Hook.*f.*, Fl. Brit. Ind. 6 (1894) 537; Ridl., Materials Fl. Mal. Pen. 3 (1907) 30; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 82; Ridl., Fl. Mal. Pen. 5 (1925) 110; Henderson, Mal. Wildfl. Monoc. (1954) 231.

Type species: *Schismatoglottis calyptrata* (Roxb.) Zoll. & Moritzi.

*Apoballis* Schott, Oest. Bot. Zeitschr. 8 (1858) 317. Type species: *Apoballis neglecta* Schott [*nom. superfl. pro Schismatoglottis rupestris* Zoll. & Moritzi *ex* Schott; = *S. latifolia* Miq.].

*Colobogynium* Schott, Oesterr. Bot. Zeit. 15 (1865) 34. Type species: *Colobogynium tecturatum* Schott [= *Schismatoglottis tecturata* (Schott) Engl.].

Evergreen, sometimes colony-forming herbs mostly of rain forest floor or rheophytes, with

clear sap and the vegetative tissue not or barely aromatic; stem hypogeal and then rhizomatous, hapaxanthic (no renewal growth of axis after flowering) and suckering or stoloniferous, or epigeal and sympodial, pleonanthic, erect, decumbent or creeping; leaves several together, simple, lanceolate to cordate, often variegated, with pinnate primary venation and striate secondary venation, pink, bronze or green when young; petiole well developed, sheathing basally, sometimes narrowly and thinly alate on adaxial angles and the wings then often crisped, sometimes asperous or minutely hairy or velvety; sheath persistent to deliquescent, sometimes free-ligulate (not in Peninsular Malaysia). Inflorescence mostly powerfully fragrant (esters), anatomically terminal, sometimes physiognomically lateral by displacement, rarely and irregularly anatomically lateral where lateral "vegetative" shoots flower "terminally" without producing foliage leaves, rarely solitary, usually several to many together in sympodial series interspersed with cataphylls forming a synflorescence; peduncles generally short and erect at anthesis, sometimes long and abruptly down-turned apically (*S. longifolia*), after anthesis usually actively declinate; spathe weakly to strongly constricted approximately at the mid-point, the lower part ("tube": but not tubular) convolute and ovoid, persistent into fruiting, the upper part ("limb") broad and inflated to gaping at anthesis, then caducous to deciduous, to narrow and clasping (opening slightly at anthesis, then closing) and shortly persistent then falling, often conspicuously mucronate, green to yellowish white; spadix shortly stipitate to sessile, sometimes partly adnate to the spathe, subequalling the spathe in length; female zone of naked pistils accompanied by clavate to mushroom-shaped to globose sterile organs usually interpreted as staminodes, these very irregularly interspersed among the pistils, distant to clumped, sometimes occurring in two sizes (*S. brevipes*, *S. mutata*), sometimes absent from among the pistils but then occuring as a single ring at the base of the female zone or as a sterile zone at its distal end; male zone contiguous with female zone or separated by a sometimes partly naked sterile zone; a distal appendix of staminodes usually present, sometimes entirely absent or very much reduced; ovaries globose to flask-shaped, unilocular with 2–4 parietal placentas, multiovulate; ovules anatropous or hemianatropus; style short to nil; stigmas mostly papillate; male flowers not recognizable as such, the zone a mass of stamens, or male flowers 2–3-staminate; stamens truncate, the thecae equalling to exceeding the connective, opening by apical pores; pollen shed in monads, powdery or rarely extruded in thin filaments (*S. scortechinii*), small, *c.* 17mm, inaperturate, boat-shaped, elliptic to oblong, bilaterally symmetrical, exine sculpturing psilate (microscopic details from Grayum 1992); staminodes of the appendix generally different in form, colour and reaction to alcohol from those of the female zone (appendical and interpistillar type staminodes occurring together between the male and female zones in *S. scortechinii*); ripening fruit enclosed by persistent spathe base; ripe fruit green, exposed by spathe dehiscing acropetally (where known); seeds numerous, small, longitudinally striate where known, minutely strophiolate, albuminous; x = 13; 2n = 26, 39, 52, with B chromosomes sometimes present (Petersen 1989).

Engler & Krause (1912) recognized 14 species from Peninsular Malaysia, reduced here to seven, including four highly variable entities, *S. calyptrata, S. mutata*, *S. scortechinii* and *S. wallichii*.

In spite of considerable diversity within the genus in spadix structure, male "flower" structure, spathe behaviour during anthesis, leaf structure and stem architecture, infrageneric classification was not attempted at all by Engler & Krause (1912) who abandoned Engler's earlier (1879) scheme (which was based on far fewer species; the number known increased almost 10-fold in the interim). The species of *Schismatoglottis* in the Malay Peninsula, though rather few, are quite diverse, some without clear relationships to others in the area. *S. brevipes* and *S. mutata* are closely related to one another and to the more widespread *S. latifolia* Miq. *S. brevicuspis* is evidently related to a group of species in Borneo including *S. retinervia* Furtado, but not to other Peninsular species. *S. calyptrata* and *S. wallichii* are evidently both members of a "euschismatoglottis" grouping which includes many species and covers the entire old-world range of the genus. *S. scortechinii* appears quite isolated, with possible relationship to Bornean *S. asperata* Engl. The highly distinctive *S. longifolia* also appears isolated, though a species collected recently in Sarawak is very similar in aspect, but, according to Bogner (pers. comm.) the latter has the basal placentation of *Hottarum*, but it lacks the free ligulate leaf sheath of that genus. Clearly these relationships require further exploration, and even an interim informal infrageneric scheme does not seem useful amongst so few species.

## KEY TO THE SPECIES OF *SCHISMATOGLOTTIS* IN PENINSULAR MALAYSIA AND SINGAPORE

1. Stem epigeal ..... 2
   Stem hypogeal ..... 5

2. Leaf sheath persistent; spadix covered with flowers/floral organs ..... 3
   Leaf sheath deliquescent-deciduous, turning brown; spadix axis partly naked between male and female zones ..... 4

3. Leaves of a rich deep green with distinctly tesselate fine venation, never variegated; upper spathe bright green, hardly opening, semipersistent; male zone about equalling appendix ..... 6. *S. brevicuspis*
   Leaves dull mid/dark green to pale green, sometimes glaucous, sometimes variegated; upper spathe opening cowl-like, pale greyish green, more or less caducous, blackening; male zone much shorter and narrower than appendix ..... 5. *S. scortechinii*

4. Feeble plants with decumbent to creeping stem *c.* 1 cm diam; leaf bases obtuse to slightly cordate; male zone and appendix together less than half the length of the spadix ..... 3. *S. brevipes*
   Robust herbs with erect to decumbent stem *c.* 2–4 cm diam; leaf base deeply cordate; male zone and appendix together exceeding half the length of the spadix .. 4. *S. mutata*

5. Inflorescences nodding on long slender peduncles ..... 7. *S. longifolia*

Inflorescences erect, the exposed part of the peduncle shorter than the inflorescence ..... 6

6. Leaf bases acute to truncate, very rarely somewhat cordate; spadix cylindric with a distinct sterile zone between the male and female zones and the appendix absent or extremely reduced (a few terminal staminodes) ..... 2. *S. wallichii*
Leaf bases cordate with the posterior lobes rounded to more or less triangular; spadix hour-glass shaped, with the narrowest portion at the junction of the male and female zones; interzonal sterile zone more or less absent (sometimes a small concentration of interpistillar staminodes) and the appendix conspicuous, hemispherical to bullet-shaped ..... 1. *S. calyptrata*

**1. Schismatoglottis calyptrata** (Roxb.) Zoll. & Moritzi in Moritzi, Syst. Verz. (1846) 83; Schott, Prodr. Syst. Aroid. (1860) 321; Engl. in DC. Monogr. Phan. 2 (1879) 352; Ridl., Materials Fl. Mal. Pen. (1907) 31, J. Straits Branch Roy. Asiat. Soc. 57 (1910) 112, Fl. Mal. Pen. 5 (1925) 111; Engl. & Krause in Engl., Pflanzenr. 55 (IV.23Da) (1912) 114; Henderson, Mal. Wildfl. Monoc. (1954) 231, fig. 137A; Chin, Gard Bull. Sing. 35 (1982) 182. Type: *Arisarum esculentum* Rumph., Herb. Amboin. 5 (1747) t. 111, fig. 1. (lecto, selected here; see below). (Fig. 2A)

*Calla calyptrata* Roxb., Fl. Ind. 3 (1832) 514.
*Homalomena calyptrata* (Roxb.) Kunth, Enum. Pl. 3 (1841) 57.
*Zantedeschia calyptrata* (Roxb.) C. Koch, Ind. Sem. Hort. Berol. App. (1854) 9.
*Schismatoglottis calyptrata* var. *concolor* Hallier *f.*, Bull. Herb. Boiss. (1898) 620; Ridl., Materials Fl. Mal. Pen. 3 (1907) 31, Fl. Mal. Pen. 5 (1925) 111; Engl., Pflanzenr. 55 (IV.23Da) (1912) 115; *nom. superfl. pro var. typ.*

[*S. longipes sensu* Hook.*f.*, Fl. Brit. Ind. 6 (1894) 538, *non* Miq. (see below)].

[*Schismatoglottis calyptrata* var. *picta sensu* Ridl., Materials. Fl. Mal. Pen. (1907) 31, Fl. Mal. Pen. 5 (1925) 111; ?*non* (Schott) Hallier *f.* (see below)].

*Schismatoglottis calyptrata* var. *albidomaculata* (Hallier *f.*) Ridl., Materials Fl. Mal. Pen. 3 (1907) 31, *pro parte quoad specim. cit.* (see below).

*Schismatoglottis cordifolia* Ridl., J. Straits Branch Roy. Asiat. Soc. 57 (1911) 112. Type: Malaysia, Perak, Temangoh Woods, *Ridley s.n.* (SING!, holo).

*Schismatoglottis calyptrata* var. *ornata* Ridl. *ex* Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 116; Ridl., Fl. Mal. Pen. 5 (1925) 111. Type: *Ridley s.n.* (SING!, holo).

*Schismatoglottis calyptrata* forma *minor* Engl. in Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 116. Type: Singapore, Bukit Timah, *Engler s.n.* (B, presumed lost).

Stoloniferous herb forming colonies; stems hypogeal, hapaxanthic, with several leaves together; leaves usually dull mid-green, sometimes bivittate grey or spotted (other variegation patterns recorded elsewhere in the range and likely here); blades mostly cordate to sagittate, sometimes oblong-lanceolate with the base cordate; petiole smooth, to *c.* 50 cm long (often less), *c.* 1 cm diam., sheathing for *c.* 1/3 its length, flattened adaxially with the angles rounded to sharper and sometimes minutely alate distally; wings of sheath to c. 1 cm wide, persistent, membranous, straight to slightly inrolled, tapering and fully attached to very shortly (1–2 mm) ligulate; anterior lobe *c.* 13–25 cm long, widest at the base or *c.* 1/3 along its length, *c.* 7–18 cm wide; primary lateral veins 10–15 per side diverging at 45–70°, nearly always raised adaxially towards the midrib, marginally impressed, entirely raised abaxially, sometimes branched; interprimary veins irregularly present; secondary and tertiary venation inconspicuous; posterior lobes rounded to rather sharply triangular, *c.* 2.5–10 cm long. Inflorescences 1–8 together, with a strong esteric odour at female anthesis; exposed part of peduncle short, rarely to *c.* 10 cm, erect at anthesis, then deflected; spathe to *c.* 12 cm long; lower spathe narrowly ovoid, c. half the length of the whole spathe, green, often minutely longitudinally ridged and asperous; limb separated from lower spathe by an abrupt constriction corresponding to the base of the male zone of the spadix, at female anthesis much inflated, narrowing and turbinate, the apex conspicuously mucronate, completely surrounding the spadix and gaping ventrally or with the margins loosely overlapping, creamy to pale greenish-yellow, caducous immediately after female anthesis; spadix *c.* 3/4 the length of the spathe, narrowly horologiform; female zone about half the length of the whole spadix, sessile, somewhat to markedly obliquely inserted to partially adnate to spathe, *c.* 5–8 mm diam. below, distally tapering to *c.* 3–4 mm diam.; pistils pale green, very numerous, *c.* 1 mm tall, flask-shaped and close-packed below, distally becoming more widely spaced and subglobose, finally rather widely scattered and squashed by the constricting spathe; interpistillar staminodes white, mostly conspicuously taller than pistils, few in number, scattered, stalked, clavate; sterile zone between male and female zones absent save sometimes for a relative concentration of interpistillar staminodes amongst the distal pistils; male zone narrowly obconic, approximately half the length of the female zone, distally *c.* 1 cm diam., ivory; anthers dumbbell-shaped from above, *c.* 0.5 × 1 mm, with thecae apically impressed; pollen shed through apical pores, dusty; appendix bullet-shaped to hemispherical, basally nearly always somewhat wider than apex of male zone, creamy yellow; staminodes of appendix columnar, irregularly polygonal in cross-section, *c.* 0.5 mm diam.; fruiting spathe declinate, urceolate.

DISTRIBUTION. Tropical southwestern China to Indo-China and throughout Malesia, east to Vanuatu, in lowland and lower montane rain forest and forest margin in both wet and well drained sites, from sea level to *c.* 1700 m alt.

Selected other specimens seen (this species has been collected on a great many occasions):

**PENINSULAR MALAYSIA.** Perak, Bukit Larut, *Boyce* 687 (K, KEP); Penang, Waterfall, *Curtis* 2828 (K, SING); Trengganu, Bukit Bauk Forest Reserve, *Hardial Singh* 5 (SING); Selangor, Langat, Ulu Lui, *Hassan-Kasim s.n.* (SING); Perlis, Bukit Bintang, nr Kangar, *Hay et al.* 9013 (distr. ex cult. Hort. Reg. Bot. Sydney, Acc. No. 940058); Selangor, Gombak Valley, *Hay et al.* 9042, 9056 (distr. ex cult. HRBS, 940086, 940100); Perak, foothills of G. Bubu, *Hay et al.* 9129 (distr. ex cult. HRBS, 940125); Negeri Sembilan, Jaram Toi Recreation Area, *Hay et al.* 9155 (distr. ex cult. HRBS, 940151); Perak, Bukit Larut, *Hay et al.* 9087, 9088, 9089, 9090 (distr. ex cult. HRBS, 940181, 940182, 940183, 940184); Terengganu, Ayer Terjun, Sekayu F.R., *Hay et al.* 9217, 9238, 9239 (distr. ex cult. HRBS, 940285, 940306, 940307); Pahang, The Gap, Semangoh Pass, *Hay et al.* 9272 (distr. ex cult. HRBS, 940339); Pahang, Bukit Fraser, *Hay et al.* 9273, 9292 (distr. ex cult. HRBS, 940340, 940359); Pahang, Kuala Tembeling, *Holttum* 20536 (SING); Johor, G. Pulai, *Maxwell* 81-8 (SING); Kelantan, Kuala Relai, *Mohd. Nur* 10227 (SING); Negeri Sembilan, Perhentian Tinggi, *Ridley s.n.* (SING); Perak, *Scortechini* 622a (CAL, K, SING). **SINGAPORE.** Bukit Timah, *Ridley s.n.* (SING).

Putative hybrid with *S. wallichii*:
**PENINSULAR MALAYSIA.** Negeri Sembilan, Jaram Toi Recreation Area, *Hay et al.* 9159 (distr. *ex* cult. HRBS, 940155).

Apparently no material of *Calla calyptrata* was preserved by Roxburgh. However, he had a drawing made (No. 1661 (K!, CAL)) and he also cited *Arisarum esculentum* Rumph. as a synonym. The lectotype, Rumphius' plate of *Arisarum esculentum*, is stylised, nevertheless it does clearly represent a *Schismatoglottis*: parallel leaf venation, caducous spathe limb and wings of the leaf sheath adnate to the petiole (cf. the free-ligulate sheath in, e.g., *Piptospatha* and a few *Schismatoglottis* spp.). In addition, the plant figured is clearly stoloniferous, the leaf blades are ovato-sagittate, the stem is hypogeal without evidence of renewal growth and the spathe limb is broadly inflated. Hence the illustration accords with *S. calyptrata* in the current sense. However, the representation of the spadix is inadequate for unequivocal distinction of the species in a genus in which vegetative features may vary greatly and reproductive differences are often quite narrow. The other candidate for selection as lectotype, Roxburgh's above-mentioned drawing, is also rather stylised and inadequate for precise identification. It includes a somewhat rudimentary analytical drawing of the spadix, a pistil and a stamen, but it erroneously (for any species of *Schismatoglottis*) represents the primary leaf venation as joined intramarginally and the stem as a tuberous rhizome with the leafy crown subtended by cataphylls as though the plant was a deciduous geophyte. To define the application of the name unequivocally, an epitype (Art. 9.7, Tokyo Code) is required, conforming with the sense in which the name is generally applied. It seems desirable, though not imperative, that this should be selected from Amboina material if possible, since Roxburgh based his description of *Calla calyptrata* on living material cultivated at Calcutta obtained from that island. The only adequate specimen that I have seen of this species collected in Amboina is that of Zippelius (*s.n.*; L!). However, I shall forbear to select an epitype until I have seen material of

Robinson's Pl. Rumph. Amb. 112 (see Merrill, 1917), which may be more widely distributed than the Zippelius specimen.

The distinctive (in Peninsular Malaysia) dome-shaped appendix and obconic male zone are also found in a number of Bornean and Javan species with distinct ecology and vegetative morphology and does not, on its own, serve to identify this species. It is distinguished by these features together with the stoloniferous habit, the dull green leaves in which the primary lateral venation is usually faintly raised on the adaxial side, especially near the midrib. The interpistillar staminodes are significantly taller than the pistils in Malaysian material, whereas in the eastern part of the range, e.g., in New Guinea, the interpistillar staminodes approximately equal the pistils in height.

A few specimens occur which are intermediate between this species and *S. wallichii* (e.g., Hay *et al.* 9159). In the latter species, the sterile and male zones of the spadix are in reverse order to that in *S. calyptrata*, so that there is no appendix (though there may be a very small terminal cluster of staminodes at the spadix apex). In the intermediate specimens, the male zone is longer than in *S. calyptrata s.s.* and is separated from the female by a narrow zone of staminodes of the type found in the appendix of *S. calyptrata* and the sterile zone in *S. wallichii s.s.* The appendix is much shorter, and the distal portion of the spadix is rather narrowly clavate: i.e., intermediate between the more or less cylidrical spadix of *S. wallichii* and the abruptly clavate one of *S. calyptrata* and without the slight but abrupt difference in width between the male zone and appendix of the latter species. Occasional specimens are also found in which the structure of the spadix is typical for *S. calyptrata* except for a very short sterile zone between the male and female zones; these have been determined as *S. calyptrata*, but if hybridization has taken place with *S. wallichii*, they may suggest that some introgression is occurring. Cytological investigation and experimental crossing are required to confirm whether or not these species are genetically isolated. The descriptions of both *S. calyptrata* and *S. wallichii* presented here are based on material adjudged to be broadly "typical".

The forms and varieties listed above in synonymy are those which have been applied to leaf variegants among Peninsular Malaysian material. There are additional ones from other parts of the range. Though they are circumscribable, none is formally maintained here since, as noted in the introduction, a great many species of *Schismatoglottis* show the same or a very similar, possibly homologous range of variegation patterns and to recognise forms in one species would demand that they be erected for dozens more. Instead, variation in variegation patterns has been incorporated into the species decriptions as being a characteristic at species level.

Burkill (1935) cited reports that the "root" and leaves are edible.

*S. cordifolia* was distinguished by Ridley (1911) on the grounds of its narrow leaf shape and the "[male] flowers with more sinuous margins than in *S. calyptrata*". The former character

is of no significance, the range of leaf form in *S. calyptrata* being great. The latter character appears to have more to do with the stage of ripeness of the anther thecae than with a taxic difference in morphology. *S. longipes* Miq. was placed in the synonymy of *S. calyptrata* by Engler & Krause (1912). I have not yet had the opportunity to confirm that this is correct. However, the Malayan material determined as *S. longipes* by Hooker (*loc. cit.*; *Scortechini 622a*) is clearly *S. calyptrata* with slightly longer than usual peduncles, so I have included only *S. longipes sensu* Hook.*f.* as a synonym for the present. *S. calyptrata* var. *picta* (Schott) Hallier *f.* was based on *S. picta* Schott, in turn based on material from Java. The type of *S. picta* may be conspecific with *S. calyptrata*, though this is yet to be verified. Nevertheless Malayan material cited under var. *picta* by Ridley (*ll.cc.*) is clearly *S. calyptrata*. Ridley (1907: 31) attributed the varietal name "*albidomaculata*" to Hallier (1898: 621). This name appears at the rank of *forma* there, while var. *albidomaculata* Hallier *f.* had only appeared invalidly as a *nomen nudum* in Hallier (1897: 260). I conclude that valid var. *albidomaculata* is attributable to Ridley (1907: 31), based on Hallier's form of the same name. A type has not been located, but it is not a Malayan plant in Hallier's sense.

**2. Schismatoglottis wallichii** Hook.*f.*, Fl. Brit. Ind. 6 (1894) 537; Ridl., Materials Fl. Mal. Pen. 3 (1907) 33, Fl. Mal. Pen. 5 (1925) 112; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 98, fig. 63; Henderson, Mal. Wildfl. Monoc. (1954) 232, fig. 137, B,C,D. Type: Malaysia, Perak, *Scortechini* 237b (K!, lecto; SING!, iso-lecto, selected here). (Fig. 2B)

*Schismatoglottis wallichii* var. *oblongata* Hook.*f.*, *loc. cit.*; Ridl. Materials Fl. Mal. Pen 3 (1907) 33, Fl. Mal. Pen. 5 (1925) 112. Type: Malaysia. Perak, Gopeng, *Kunstler* 4660 (K!, lecto; CAL!, iso-lecto, selected here).

*Schismatoglottis wallichii* f. *oblongata* (Hook.*f.*) Engl. & Krause, *loc. cit.* p.100.

*Schismatoglottis wallichii* var. *fasciata* Ridl., Materials Fl. Mal. Pen. 3 (1907) 33, J. Straits Branch Roy. Asiat. Soc. 57 (1910) 112, Fl. Mal. Pen. 5 (1925) 112. Type: Malaysia, Selangor, Pahang Track, *Ridley* 14443 (SING!; holo).

Clump- to colony-forming, usually stoloniferous herb, sometimes with individual crowns markedly distant; stems hapaxanthic, hypogeal, with up to *c.* 5 leaves per module; petiole *c.* 15–45 cm long, smooth, adaxially flattened to somewhat channelled, the angles blunt to somewhat acute but not alate, sheathing in lower *c.* 1/4; wings of sheath persistent, membranous, straight to slightly inrolled, to *c.* 1 cm wide, tapering, fully attached except for *c.* 1 mm ligulate apex; blades very variable in shape, mostly ± oblong-ovate, occasionally broadly ovate to oblong-lanceolate, the base acute to obtuse, more rarely truncate to cordate, mid- to very dark green and dull to somewhat glossy adaxially, paler and dull green abaxially, often variegated with a central dark green strip, bivittate grey-green, spotted yellow-green (observed by me only in Sarawak material), or occasionally with a pale midrib, 30 × 17 cm to 23 × 4 cm to 12 × 5 cm; primary lateral veins impressed

adaxially, prominent abaxially, (6–)10–14 on each side of the midrib, 1.5–3 cm apart, diverging at 30–90°; interprimary veins irregular but conspicuous; secondary venation often very inconspicuous, tertiary venation barely visible; posterior lobes 0–6 cm long. Inflorescences 2–several together, with a powerful esteric odour; peduncle mostly hidden within the subtending leaf sheath, to *c.* 12 cm long; spathe *c.* 8–18 cm long; lower spathe more or less cylindrical at anthesis, green, to 2.5 cm wide; limb (incl. mucro) about equalling the lower spathe in length, ivory to pale yellow, inflated to *c.* 4 cm wide and turbinate at anthesis, slightly gaping or with the margins loosely overlapping, thence abruptly caducous, the interface between the limb and the lower spathe only weakly constricted; spadix to *c.* 12 cm long, sessile, cylindrical to distally subclavate; female zone about half the length of the spadix, obliquely inserted to adnate for *c.* 1/2 its length to the spathe; interpistillar staminodes scattered, narrowly stalked and clavate-headed, about twice the height of the pistils, sometimes also crowded at the interface between the female and sterile zones; ovaries more or less flask shaped. *c.* 1 mm tall; stigma sessile, button-like; sterile zone interposed between female and male zones abruptly but slightly thicker than distal part of female zone, cylindrical, somewhat shorter than (then hidden within lower spathe) to somewhat exceeding (then distally exposed from mouth of lower spathe) the male zone, composed of columnar, flat-topped staminodes markedly dissimilar to interpistilar ones; male zone cylindric with the apex rounded, to somewhat clavate, composed of stamens not aggregated into recognisable "flowers", *c.* 0.7–1 cm diam.; stamens ± rectangular to dumbbell-shaped from above (connective reaching anther apex in the former, not in the latter), the filament slab-like, *c.* 1 mm tall, the thecae impressed apically, the rims interrupted laterally by a narow slit; pollen ivory, dusty; appendix absent or reduced to a small cluster of columnar staminodes at the summit of the male zone apex (but see discussion of putative hybrids under *S. calyptrata*); 2n = 26 (see Petersen, 1989).

DISTRIBUTION. Peninsular Malaysia and Singapore where it is common and widespread in the lowland and lower montane rain forest to *c.* 1500 m alt. It has also occasionally been collected in Sarawak (e.g., at Lundu).

Selected other specimens seen (this species has been collected on many occasions):

**PENINSULAR MALAYSIA.** Selangor, Ulu Gombak, *Boyce* 675 (K, KEP); Johor, Pulau Tinggi, *Burkill* 917 (SING); Selangor, Sungei Buloh, *Chin & Jacobsen* 3364 (K, L); Selangor, Kuala Lumpur, *Curtis* 2393 (SING); Province Wellesley, Ulu Kubang, *Curtis s.n.* (SING); Pahang, Kemaman, Bukit Kajang, *Corner* 30233 (K, SING); Melaka, Bukit Sadanen Reserve, *Derry* 345 (SING); Trengganu, Bukit Bauk Forest Reserve, *Hardial Singh* 4 (K, L, SING); Pahang, Sungei Yu, *Hardial Singh & Mohd. Nur* 105 (K, SING); Selangor, Gombak Valley, *Hay et al.* 9051, 9054, 9055 (distr. ex cult. HRBS, 940095, 940098, 940099); Negeri Sembilan, Jaram Toi Recreation Area, *Hay et al.* 9159 (distr. ex cult. HRBS, 940155); Johor, G. Panti via Kg. Lukit, *Hay et al.* 9195, 9196, 9198 (distr. ex cult. HRBS, 940263, 940264, 940266); Johor, Kota Tinggi-Mersing Rd., *Hay et al.* 9207 (distr. ex cult. HRBS, 940275); Terengganu, Ayer Terjun, Sekayu F.R., *Hay et al.* 9218,

9219, 9229, 9242, 9244, 9245, 9246, 9255, 9258 (distr. ex cult. HRBS, 940286, 940287, 940297, 940310, 940312, 940313, 940314, 940323, 940326); Pahang, Bukit Fraser, *Hay et al.* 9287 (distr. ex cult. HRBS, 940354); Selangor, Rantau Panjang Forest Reserve, *Hume* 7544 (SING); Negeri Sembilan, Bukit Tangga, *Nur* 11782 (K, SING); Perak, *Scortechini* 237b (K); Perak, Tapah, *Wray* 803 (CAL). **SINGAPORE.** Bukit Timah, *Goodenough s.n.*, *Ridley s.n.* (both SING).

This species is extraordinarily variable in vegetative characters, and it is surprising that there are not more synonyms. Habit ranges from stoloniferous with few-leaved crowns through to clump-forming with multifoliar crowns. Leaf shape varies from cordatosagittate (rare) through sagittate, subtriangular, oblong, ovate-elliptic to oblong-lanceolate. Leaf colour ranges from dark to pale green, variegated yellow-green or grey-green or not, variegated in fasciate or spotted patterns, primary lateral venation widely to narrowly spaced and diverging at low to high angles. The unifying factor is the comparatively constant inflorescence morphology with its very distinctive long sterile zone between the female zone and the male zone which is terminal (though a few staminodes may be present at the very apex of the spadix).

Burkill (1935) cited a report that the "root" is edible.

**3. Schismatoglottis brevipes** Hook.*f.*, Fl. Brit. Ind. (1894) 538; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 102, fig. 56. Type: Malaysia, Perak, *Scortechini* 623b (K!, holo) (Fig. 2C)

*Schismatoglottis minor* Hook.*f.*, *loc. cit.*; Ridl., Materials Fl. Mal. Pen. 3 (1907) 32, Fl. Mal. Pen. 5 (1925) 113; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 105. Type: Malaysia, Perak, *Scortechini* 532b (K!, holo).

[*Schismatoglottis brevicuspis auctt. non* Hook.*f.*: Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 98, *pro parte quoad specim. cit. Curtis s.n.* (Penang, Waterfall), *Ridley s.n.* (Pahang, Tahan R.; Selangor, Petaling), see below].

[*Schismatoglottis scortechinii auct. non* Hook.*f.*: Ridl., Fl. Mal. Pen. 5 (1925) 113, *pro parte quoad S. brevipes in synon.*].

Stem epigeal, pleonanthic, to *c.* 30 cm long, *c.* 8 mm diam., decumbent, creeping to trailing, internodes *c.* 1–3 cm long, with sylleptic renewal growth; leaves 1–6 per module; petiole *c.* 15 cm long, *c.* 3 mm diam., the margins minutely alate and sometimes crisped, slightly asperous, minutely hairy/spinulous (hand lens required), pale green to purplish, sheathing for (50–)65–75% of its length; wings of sheath, at least in upper half, degrading, becoming dark brown and flaking shortly after the emergence of the enclosed leaf, *c.* 5 mm wide, ± straight, tapering, not ligulate; blade (thrice to) twice as long as broad, (elliptic to) ovate,

widest about the mid-point, the base obtuse to rather weakly cordate, the tip acute to weakly acuminate, pale to mid green, slightly glossy to dull, not variegated, usually tinged bronze when young, the margin smooth to weakly undulate; anterior lobe to *c.* 12 cm long; posterior lobes (0–) *c.* 8 mm; primary venation only faintly prominent above, prominent below, diverging from the midrib at 50–70°, *c.* 1 cm apart; interprimary veins present; secondary venation flush adaxially and abaxially, arising from the midrib and the bases of the primary veins; tertiary venation not or faintly visible adaxially, visible abaxially, forming a tesellate pattern. Inflorescences 1–5 together; peduncle to *c.* 5 cm, thin, 2.5 mm diam., erect at anthesis, then dangling; spathe 5.5–7.5 cm long; lower spathe narrow ovoid, to 3.5 cm long, 1.5 cm wide, green; limb persistent until well after anthesis, then deliquescing, lanceolate, acuminate tipped, opening only slightly, the distal portion remaining convolute, with only the ventral part of the male zone exposed; spadix 5–6 cm long; female zone 2–2.5 cm long, ± cylindrical, slightly curved towards dorsal side of spathe, obliquely inserted to adnate for *c.* 1/3 its length; interpistillar staminodes numerous, irregularly distributed, *c.* 1 mm high, larger than the pistils, globular, very shortly stalked, white; pistils c. 0.75 mm diam., globose-polyhedral, pale green, somewhat distant and sometimes patchily distributed; style nil; stigmas globose; interzonal staminodial region 1–1.3 cm long, cylindrical to slightly tapering. 5–8 mm thick, partly naked, consisting proximally of rather crowded structures resembling interpistillar staminodes, distally of scattered groups of much smaller staminodes resembling the stamens; male zone *c.* 1.5 cm long, 5 mm thick, cylindrical to slightly spindle-shaped, the lower part corresponding with the spathe constriction; male flowers not recognizable as such, the zone ostensibly a mass of stamens; filament rather slender, slightly shorter than the thecae; anther 1 mm wide, dehiscing through apical pores; pollen dusty, white; appendix very short, 3–5 mm long, conic; staminodes of appendix columnar, ivory white, *c.* 1 mm diam.; fruiting spathe declinate, urceolate.

DISTRIBUTION. Endemic to Peninsular Malaysia and so far only recorded from Perak in lowland hill forest to *c.* 1000 m alt., in damp places.

Other specimens seen:

**PENINSULAR MALAYSIA.** Penang, Waterfall. *Curtis s.n.* (SING), *Curtis* 1884 (SING); Pahang, Bentong-Raub boundary, *Furtado s.n.* (SING); Perak, Bukit Larut, *Hay et al.* 9072 (UPM & distr. ex cult. Hort. Reg. Bot. Sydney. Acc. No. 940168), 9075 (distr. ex cult. HBRS, 940171), 9104 (UPM & distr. ex cult. HBRS, 940198); Perak, foothills of Gunong Bubu, *Hay et al.* 9128a (distr. ex cult. HBRS, 942586); Kelantan, base of Bukit Batu Papan, *Henderson* 29562 (SING); Johor, Bukit Tunjok Laut, *Ngadiman* 36933a (SING), 36947 (K, SING), 37088 (SING); Pahang, Tahan R., *Ridley s.n.* (SING); Selangor, Petaling station, *Ridley s.n.* (SING); Perak, Temangoh, *Ridley* 14308 (K, SING); Gua Batu Puteh, *Wray* 1206 (CAL, SING).

The type of *S. brevipes*, which has only the female portion of the spadix and the

corresponding lower spathe, was considered by Ridley (1907) to represent a young plant of *S. scortechinii*. However, it is a clearly distinct and not closely related species. Engler & Krause's (1912) description (based on *Wray* 1206) of a white spathe appears to be incorrect.

*S. minor* represents a weak, creeping aspect of this species. Plants corresponding with this in cultivation maintain their slender habit and smaller dimensions of their reproductive parts. However, there are linking intermediates to more robust decumbent-stemmed forms in which the inflorescences are substantially larger and with larger ovaries and interpistillar staminodes. In the smaller forms, the lower part of the female zone is adnate to the spathe (to *c.* 1/3 in my observation, not the 1/2 noted by Hooker and repeated by Engler and Ridley), in more robust plants oblique insertion rather than adnation better describes the lower part of the female zone.

**4. Schismatoglottis mutata** Hook. *f.*, Fl. Brit. Ind. 6 (1894) 538; Ridl., Materials Fl. Mal. Pen. 3 (1907) 32, Fl. Mal. Pen. 5 (1925) 111; Engl., Pflanzenr. 55 (IV.23Da) (1912) 110; Henderson, J. Malayan Branch Roy. Asiat. Soc. 5 (1927) 275, J. Malayan Branch Roy. Asiat. Soc. 17 (1939) 84; Chin, Gard. Bull. Sing. 35 (1982) 182. Type: Malaysia, Perak, Bukit Larut, *King's Collector* 4443 (K! lecto, CAL! isolecto; selected here). (Fig. 2D)

*Schismatoglottis ridleyana* Engl., Pflanzenr. 55 (IV.23Da) (1912) 116. Type: Perak, Bukit Larut, *Curtis* 2076 (SING!, lecto; selected here).

*Schismatoglottis linguiformis* Engl., Pflanzenr. 55 (IV.23Da) (1912) 93; Ridl., Fl. Mal. Pen. 5 (1925) 112. Type: Malaysia, Perak, *Scortechini* 1197 (CAL!, holo).

Rather slender to moderately robust erect herbs *c.* 0.35–1.1 m tall; stem epigeal, pleonanthic, *c.* 2–4 cm thick, in the upper part often clothed with the remains of old leaf bases, the lower part naked as these rot; internodes *c.* 1–4 cm diam., often with conspicuous rather thick roots; leaves *c.* 5 per module, very variable in size; petiole *c.* 20–45 cm long, smooth to very faintly asperous to minutely velvety-hairy (hand lens), adaxially flattened to slightly channelled with the angles rounded to distally inconspicuously alate, pale green to bright dark red, sometimes somewhat glaucous (due to minute hairs, not wax), sheathing in the lower 1/3–3/5; wings of sheath membranous, deliquescent/marcescent ± immediately after emergence of leaf within; blade broadly to narrowly ovatosagittate, somewhat glossy bright mid-green to dull mid-green, usually bronze-tinged to pink when newly emerged; anterior lobe *c.* 12 × 7–40 × 30 cm, widest from at the base to about 1/3 along midrib, the tip acute to shortly acuminate; primary venation 9–15 per side, sometimes branched, diverging at *c.* 50–70°, impressed adaxially, prominent abaxially; interprimary veins rather conspicuous and raised abaxially, impressed adaxially; secondary venation flush with lamina and mostly inconspicuous; tertiary venation inconspicuous; posterior lobes prominent, always forming a rather deeply cordate blade base, *c.* 3–12 cm long, triangular to rounded and sometimes almost overlapping across the sinus; posterior costae sometimes

clearly differentiated for a few millimetres before dividing into primary venation of posterior lobes, occasionally naked in the sinus for 2–3 mm, more usually with lamina to the sinus and occasionally sub-peltate; inflorescences 2–several together on rather short slender peduncles which sometimes flop out of the subtending leaf sheath or cataphyll as these deliquesce/marcesce; spathe *c.* 7–15 cm long; lower spathe *c.* 1/3 the length of the whole, ovoid to subglobose at female anthesis, green to red to bright pink (correlated with petiole colour); spathe limb narrowly lanceolate, clasping the spadix, barely opening at anthesis, thence closing again and temporarily persistent, eventually marcescent or breaking away after senescing, yellowish ivory to pale orange to bright pink; spadix ± cylindrical-tapering, subequalling the spathe, sessile, obliquely inserted; female zone *c.* 1/3 the length of the spadix, cylindric, *c.* 8–10 mm diam. at base, slightly tapering distally; interpistillar staminodes very sparsely to irregularly densely distributed amongst the ovaries, but usually concentrated at the very base of female zone, stalked and clavate-headed, somewhat taller than and conspicuously larger than the pistils; immediately distal to female zone a somewhat complex 1–2 cm long sterile interstice composed of basal sessile interpistillar staminodes, then a concentration of smaller sessile staminodes, these becoming distant distally in small groups of commonly 2–4 surrounded by naked spadix tissue, these then usually concentrated again in an incomplete ring adjunct to the male zone; male zone ± cylindrical, *c.* 1.3–3.3 cm long; stamens not aggregated into "flowers", small, rectangular-dumbbell-shaped from above, 0.5 × 1 mm, with the thecae impressed, dehiscing by apical pores; pollen ivory, dusty; appendix exceeding to shorter than the male zone, *c.* 1.5–3 cm long, tapering and pointed to cylindric and round-tipped, basally the same diameter as the male zone, rarely narrowly ovoid, composed of columnar flat-topped staminodes; fruiting spathe declinate, narrowly ovoid.

DISTRIBUTION. Thailand and widespread in Peninsular Malaysia from the lowlands to *c.* 1500 m alt. Lowland rain forest to lower montane forest; sometimes on limestone in wet places.

Other specimens seen:

**PENINSULAR MALAYSIA.** Perak, Bukit Larut, *Boyce* 689 (K, KEP); Perak, Kuala Kangsar, *Boyce* 708 (K, KEP); Penang, Moniots Rd, *Burkill* 2678 (SING); Pahang, Bukit Fraser, *Burkill & Holttum* 8696 (SING); Selangor, Ulu Gombak, *Croat* 53310 (K); Penang, Moniots Rd, *Curtis s.n.* (SING); Perak, Sungei Batang Padang, Tapah Hill reserve, *Furtado* 33097 (K, SING); Selangor, Gombak Valley, *Hay et al.* 9042 (distr. ex cult. Hort. Reg. Bot. Sydney, acc. no. 940086); Perak, Bukit Larut, *Hay et al.* 9087, 9088 (distr. ex cult. HRBS 940181, 940182); Perak, foothills of Gunung Bubu, *Hay et al.* 9128, 9134 (distr. ex cult. HRBS 940124, 940130); Negeri Sembilan, Bukit Tangga, nr Jelebu, *Hay et al.* 9146, 9147 (distr. ex cult. HRBS 940142, 940143); Negeri Sembilan, Jaram Toi Recreation Area, *Hay et al.* 9155 (distr. ex cult. HRBS 940151); Terengganu, Ayer Terjun, Sekayu F.R., *Hay et al.* 9223, 9238, 9239 (distr. ex cult. HRBS 940291, 940306, 940307); Pahang, Bukit Fraser, *Hay et al.* 9273, 9275 (distr. ex cult. HRBS 940340, 940342); Perak, Batang Padang,

*Henderson* 10890 (K); Perak, Lubok Tamang, *Henderson* 10892 (SING); Pahang, Cameron Highlands, No. 4 Camp, *Henderson* 11079 (SING); Pahang, Bukit Fraser, *Henderson* 11270 (SING); Pahang, Bukit Fraser, *Henderson* 11464 (SING); Pahang, Cameron Highlands, Robinson Falls, *Henderson* 17979 (SING); Pahang, base of Kota Gelanggi, *Henderson* 22427 (K, SING); Pahang, Cameron's Highlands, *Henderson* 23353 (CAL); Negeri Sembilan, Ulu Brudok Forest Reserve, *Holttum* 9878 (SING); Terengganu, G. Padang, *Kiah & Moysey* 33942 (SING); Pahang, Bukit Fraser, *Mohd. Nur* 11283 (K); Perak, Bukit Larut (Maxwell's Hill), *Mohd. Nur* 12932 (SING); roadside Thaiping to Maxwell's Hill Station, *Nicolson* 1090 (SING); Kuala Lumpur-Bukit Fraser Highway, *Nicolson* 1162 (L, SING); 15th Mile, Pahang Rd, *Ridley* 8487 (CAL); Selangor, Gua Batu, *Ridley s.n.* (SING); Selangor, Genting Peras, *Ridley s.n.* (SING); Pahang, Telom, *Ridley s.n.* (SING); Selangor, Bukit Kutu, *Ridley s.n.* (SING); Perak, *Scortechini* 267 (K); Selangor, Ulu Gombak, *Symington* 20504 (KEP); Gua Panjang, Ulu Kelantan, *UNESCO Limestone Expedition (1962)* 528 (K, L).

As interpreted here, this is a highly variable species or a species complex which more intensive field study may resolve into further taxa. *S. ridleyana* represents a usually rather robust form with dull green broad leaves with rather prominent and close-spaced primary lateral veins and a fine dense velvety indumentum on the petioles and abaxial midrib. The new leaves are often a rather bright pink. It is common at mid-elevation on Bukit Larut. *S. linguiformis* is a less robust, narrow-leaved aspect. Forms occur with shiny pale green leaves (pale bronze when young) and more delicate forms with deep red stems and petioles (leaves bronze when young) and orange-yellow spathes. The indumentum on the leaves is commonly reduced (with intermediate states) to minute finely scattered excrescences on the petiole and midrib surface which may appear glabrous to the naked eye. The inflorescence is variable as to overall size, and in particular the relative length of the appendix and male zone. The unifying features are the narrow, shortly persistent, hardly opening spathe limb, the part-naked interval between the male and female zones, the rather to very robust more or less erect stem, deeply cordate leaves and deliquescent leaf sheath.

In Peninsular Malaysia, this species is closely allied to *S. brevipes* (*q.v.*) which differs in its much smaller size, creeping stem, usually not cordate leaf bases, green spathe limb and relatively much larger interpistillar staminodes. Further afield, it appears that *S. mutata* is closely allied to species such as *S. latifolia* Miq. (Java, Philippines, Sulawesi, *fide* Engler, 1912), *S. treubii* Engl. (Sumatra) and possibly others. It is possible that, on revision, these will merge as a widespread West and Central Malesian species, if the Peninsular Malaysia aspect cannot be fragmented.

**5. Schismatoglottis scortechinii** Hook. *f.*, Fl. Brit. Ind. 6 (1894) 537; Ridl., Materials Fl. Mal. Pen. 3 (1907) 32, Fl. Mal. Pen. 5 (1925) 113; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 100. Type: Malaysia, Perak, *Scortechini* 148 (K!, holo; CAL!, iso). (Fig. 2E)

*Schismatoglottis kingii* Engl. in Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 97, fig. 62, J. Type: Malaysia, Johor, *King s.n.* (CAL!, holo).

*Schismatoglottis marginata* Ridl., J. Bot. 40 (1902) 36, Materials Fl. Mal. Pen. 3 (1907) 34; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 89; *nom. illeg., non Schismatoglottis marginata* Engl., Bull. Soc. Tosc. Ortic. 4 (1879) 298 [i.e. *Piptospatha marginata* (Engl.) N.E. Br., Bot. Mag. 51 (1895) descr. ad t. 7410 (Borneo)]. Type: Malaysia, Pahang, Tahan woods, *Ridley s.n.* (SING!, holo).

Stem epigeal, pleonanthic, erect to decumbent or creeping, to *c.* 20 cm long, 1–2 cm thick, internodes 0.5–1 cm long, not freely rooting except when in contact with soil, renewal growth sylleptic but sometimes delayed by protracted inflorescence production; leaves 1–5 per module; petiole 10–30 cm long, 5–7 mm thick with the margins narrowly but distinctly alate and the wing crisped (rarely hardly alate), rough and longitudinally slightly ridged, dull mid-green, sheathing for about 1/3 its length; sheath persistent, membranous, the wing to *c.* 0.7 cm wide, spreading to slightly inrolled, the apex asymmetrically and bluntly ligulate for *c.* 0.7 cm, rarely the sheath tapering and fully attached throughout its length; blade c. 2–3 times as long as wide, elliptic to oblong to ovate, widest at around the mid-point, the base acute to obtuse to weakly cordate, the anterior lobe 15–30 cm long, grey-green to yellow-green to mid-green, not glossy, variegated spattered, bivittate or vittate in shades of grey-green or yellow-green; primary venation flush to more usually somewhat impressed adaxially, prominent adaxially, diverging at 45–90° with strongly acroscopic to flattened wide courses, 1–2 cm apart; interprimary veins present; secondary venation flush adaxially and abaxially, originating on the midrib and lower parts of the primary veins; tertiary venation inconspicuous; posterior lobes, if present, to *c.* 1.2 cm long. Inflorescences 1–8 together, with a strong sweet esteric odour at anthesis, turning dark brown in spirit; peduncle *c.* 5 cm long, *c.* 4 mm thick but thickening distally into the spathe base, erect at anthesis, then deflected; spathe 6–10 cm long; lower spathe narrowly ovoid to rhomboid in outline, 2–3.5 cm long, 1–1.5 cm wide, green; limb separated from lower spathe by an abrupt constriction, membranous, pale grey-green at first, broadly oblong with the tip mucronate, opening cowl-like, sometimes more so at the base than the apex, revealing the whole appendix and the distal part of the male zone, then deciduous, turning dirty dark grey and dying as it falls; spadix 5.5–9.9 cm long; female zone 1.5–2 cm long, ± conic, c. 1 cm thick, obliquely inserted; interpistillar staminodes (absent to) few to frequent, scattered, slightly taller than the pistils, the tops button-like, irregularly rounded-polygonal, white, *c.* 0.5 mm diam.; pistils *c.* 1.5 mm high, *c.* 1 mm diam., pale green, stigmas sessile, very flat and contiguous, somewhat impressed centrally; interzonal staminodial region torus-shaped, slightly thicker than both female and male zones, about 3–4 mm long, composed of two types of staminodes either of which may predominate or they are equally represented – proximally a crowd of structures more or less identical with the interpistillar staminodes, distally a crowd (or ring) of structures more or less identical with the staminodes of the appendix (see below); male zone 0.6–1 cm long, 4–6 mm thick, cylindric, ivory, narrower than the female zone and markedly narrower than the lower part of the appendix,

corresponding with the constriction of the spathe; male flowers (1–)2–3-staminate, the anthers trapezioid to triangular from above, terminal on slab-like filaments, opening by apical pores; pollen white, extruded in very fine filaments; appendix very large, 3–6 cm long, 0.8–1 cm thick, subcylindric, tapering, rather blunt-tipped; staminodes columnar, flat-topped, sometimes centrally impressed, in groups of 2–5, *c.* 1 mm diam., yellowish ivory to pale orange; fruiting spathe declinate, urceolate, dehiscing from the base; fruits greyish.

DISTRIBUTION. Endemic to Peninsular Malaysia, in lowland rain forest and lowland hill forest, mostly on the slopes of gulleys.

Other specimens seen:

**PENINSULAR MALAYSIA.** Selangor, Ulu Gombak Forest Reserve, *Boyce* 672 (K, KEP); Perak, Gopeng, base of G. Chanteh, *Furtado s.n.* (SING); Pahang, Bentong-Raub boundary, *Furtado* 33105a (K, L, SING); Pahang, Bentong, *Furtado* 33112 (K); Selangor, Gombak Valley, *Hay et al.* 9049 (distr. ex cult. Hort. Reg. Bot. Sydney, acc. no. 940093), 9052 (distr. ex cult. HRBS, 940096); Johor, Kota Tinggi- Mersing Road, *Hay et al.* 9205, 9206 (distr. ex cult, HRBS, 940273, 940274); Terengganu, Ayer Terjun, Sekayu F.R., *Hay et al.* 9220, 9224, 9230, 9231, 9232, 9235, 9236, 9237, 9254, 9257 (distr. ex cult. HRBS 940288, 940292, 940298, 940299, 940300, 940303, 940304, 940305, 940322, 940325); Johor, G. Beridong, *Holttum* 10969 (SING); Johor. Labis, Sg. Juasseh towards Sg. Ulu Kemidak, *Md. Shah* 2304 (SING); Selangor, Ulu Gombak, *Md. Nur* 34216 (SING); Selangor, Kanching forest, 3 mi SE of Rawang, *Melville* 4752 (K); Perak, Bujong Malacca, *Ridley s.n.* (SING); Selangor, Klang Gates, *Ridley s.n.* (SING); Selangor, Kuala Lumpur, Weld Hill, *Ridley s.n.* (K); Perak, Gua Batu Puteh, *Wray* 1201 (CAL, SING).

Spirit material of this species characteristically blackens.

*S. kingii* is based on a sterile plant which appears to match *S. scortechinii* well in leaf shape, petiole/blade ratio and in the channelled petiole with adaxial crisped wing. *S. marginata* Ridl. is a rather narrow-leaved aspect of *S. scortechinii* and does not appear to differ significantly in any other respect.

*S. scortechinii* is not closely related to other Peninsular Malaysian species, and not obviously close to any other species in the genus. Nevertheless there are similarities which suggest it is related to Bornean species including *S. asperata* Engl., *S. barbata* Engl. and *S. ferruginea* Merr. The petiolar epidermis is rough with protuberant epidermal cells which here and there agglomerate into minute multicellular pustules. Elaboration of the petiolar epidermis occurs also in *S. asperata* where there are very numerous minute recurved multicellular spinules and in *S. barbata* and *S. ferruginea* where the stem, petioles and sometimes the spathe base are covered with numerous lanceolate scale-like multicellular hairs. The leaves in this group tend to be oblong to obovate/oblanceolate and the stems are consistently epigeal.

This species is variable within and between populations. For example, the species' entire range of leaf shape, variegation and venation pattern is found in the population I collected from at Ayer Terjun, Sekayu Forest Reserve (Terengganu). Populations at Gombak and in Johor along the Kota Tingi-Mersing road have greyer leaves which are bright pink when young. The interzonal staminodial region varies from being comprised almost entirely of structures resembling interpistillar staminodes (recognized by their colour, diameter, height and reaction to alcohol) in the Gombak population, while in the Sekayu population the interzonal staminodial region is comprised either of structures resembling (by their different colour, lower height, greater diameter and darkening reaction to alcohol) staminodes of the appendix or a mixture of both kinds segregated longitudinally. While it is conventional to refer to interpistillar structures, interzonal structures and structures of the appendix as staminodes in this and other groups (e.g., Colocasieae), this would appear to be labelling as identical structures of somewhat differing homology.

**6. Schismatoglottis brevicuspis** Hook.*f.*, Fl. Brit. Ind. 6 (1894) 537; Ridl. Materials Fl. Mal. Pen. 3 (1907) 33, J. Straits Branch Roy. Asiat. Soc. 57 (1910) 113, Fl. Mal. Pen. 5 (1925) 113; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 98, *pro parte excl. specim. cit.* Curtis (Penang, Waterfall), Ridley (Selangor, Petaling; Pahang, Tahan River), [i.e. *S. brevipes* Hook.*f.*, *q.v.*]. Type: Malaysia, Perak, *Scortechini* 612 (K!, holo; CAL!, SING!, iso). (Fig. 2F)

Stem epigeal, pleonanthic, decumbent, rooting in the internodes, dull dark green, *c.* 2 cm diam.; renewal growth sylleptic, leaves 3–4 per module; petiole 5–25 cm long, to 6 mm diam., with the margins sharp to minutely winged, minutely hairy and faintly rough, deep dull green; sheath 50–75% of the length of the petiole, the wings membranous, persistent, eventually marcescent, straight, completely attached to petiole, tapering; blade pale green when young, later slightly glossy dark green adaxially, paler abaxially, not known to be variegated, somewhat chartaceous, broadly ovate to oblong ovate, to *c.* 20 cm long, base obtuse to auriculate, tip acute, rather abruptly acuminate for *c.* 1–2 cm, margin irregularly wavy; primary lateral veins numerous, slightly prominent adaxially near the midrib, the rest flush, prominent abaxially, *c.* 1 cm apart, diverging at 60–80°; secondary venation flush abaxially and adaxially, emerging from the midrib and the basal parts of the primary veins; tertiary venation forming a distinct tessellate pattern abaxially. Inflorescences 1–3 together, often smaller ones produced on somewhat reduced lateral leafy, occasionally only cataphyll-bearing, shoots following flowering of the main axis; peduncle *c.* 4 cm long, 3 mm diam., erect at and after anthesis; spathe 5–12 cm long, conspicuously mucronate for to 2 cm, shiny mid-green throughout, with a resinous odour from the bruised spathe tissue; lower spathe narrowly ovoid to ovoid, 2–4 cm long, 1–2 cm wide; limb narrowly lanceolate, separated from the lower spathe by a rather weak constriction, gaping slightly in the upper part, the lower part (like the lower spathe) convolute, rather leathery, persistent shortly after anthesis but eventually yellowing and deliquescent; spadix 4.5–9 cm long; female zone 1.5–3 cm long, slightly tapering distally, *c.* 8 mm thick, obliquely inserted to adnate for

about half its length; interpistillar staminodes absent or a very few except for a single ring around the spadix immediately below the female zone, stalked, ± flat-topped and irregularly polygonal, about twice the height of the pistils, white; pistils 0.5 mm diam., subglobose with 3–4 conspicuous longitudinal bulges, green; stigma sessile, faintly 3–4-lobed, minutely papillate; interzonal staminodial region 0.5–1 cm long, ± cylindrical, 4–8 mm thick; interzonal staminodes mushroom-shaped, *c.* twice height of pistils, *c.* 1 mm diam., white, resembling the interpistillar staminodes; male zone 1.2–2 cm long, slightly thickening distally (the base corresponding with spathe constriction), 4–8 mm thick, pale yellow, ostensibly a mass of stamens not organised into "flowers", pale yellow; stamens *c.* 1 mm tall, filament slab-like, anther terminal, flat-topped, dehiscing through 2 apical pores; pollen dusty, ivory-white; appendix 1.4–3 cm long, tapering to a point, deeper yellow than the male zone; appendical staminodes columnar, flat-topped, circular to reniform in outline, *c.* 1 mm diam., slightly taller than stamens so that appendix slightly but abruptly thicker than male zone; fruiting spathe erect, rather narrowly urceolate, dehiscing from the base; fruits grey-green.

DISTRIBUTION. Endemic to Peninsular Malaysia, in wet gulleys and among rocks by streams in lowland rain forest and lowland hill forest.

Other specimens seen:

**PENINSULAR MALAYSIA.** Kedah, G. Bongsu, nr. Terap, *Bogner* 1692 (K); Pahang, Pulau Tioman, Jason Bay, *Burkill* 1042 (K, SING); Pahang, Kemaman, Ulu Ayam, Bukit Kajang, *Corner* 30249e (SING); Selangor, Ulu Gombak, *Croat* 53276 (K); Negeri Sembilan, Beremban Forest Reserve, foot of G. Angsi, *Furtado s.n.* (SING); Perak, Sungei Batang Padang, Tapah, *Furtado* 33096 (SING); Pahang, Raub-Bentong boundary, *Furtado* 33097a (SING); Selangor, Gombak valley, *Hay et al.* 9040 (distr. ex cult. HRBS, 940084); Perak, foothills of Gunong Bubu, *Hay et al.* 9130 (distr. ex cult. HRBS, 940126); Johor, Gunong Ledang (Mt Ophir), *Hay et al.* 9172 (distr. ex cult. HRBS, 940240); Johor, Bukit Tunjok Laut, *Ngadiman* 37088 (SING); Selangor, nr. Klang Gates Reservoir, *Nicolson* 1140; Melaka, Base of G. Mering, *Ridley s.n.* (SING); Selangor, Genting Peras, *Ridley s.n.* (SING); Pahang, Temango, *Ridley* 14308 (CAL).

This species is very distinctive and easily recognisable with its epigeal stem, deep green rather thinly coriaceous ovate leaves with obtuse bases and the tertiary venation forming an easily visible tessellate pattern on the abaxial side of the lamina. The spathe is more or less uniformly green, held down amongst the leaf bases and hardly opening. Not apparently closely related to other species in Peninsular Malaysia; however, several related species occur in Borneo.

In cultivation it was noted (in *Hay et al.* 9172) that stigmas bore pollination drops at the same time as pollen was being shed. However, no fruit was set.

**7. Schismatoglottis longifolia** Ridl., J. Bot. 40 (1902) 37, Materials Fl. Mal. Pen. 3 (1907) 34, J. Straits Branch Roy. Asiat. Soc. 57 (1910) 113, Fl. Mal. Pen. 5 (1925) 114; Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 89, fig. 58. Type: Malaysia, Perak, Bukit Larut, *King's Collector* 1967 (K!; lecto, selected here). (Fig. 2G)

[*Schismatoglottis rhynchopyle* Prain, ms.].

Clump-forming herbs; stem hypogeal, hapaxanthic, to *c.* 2 cm diam.; leaves *c.* 5 per module; petiole *c.* 25–40 cm long, smooth, somewhat flattened adaxially, with the angles rounded to acute, sheathing in the lower *c.* 1/2; wings of sheath membranous, peristent, to *c.* 1 cm wide, straight to slightly inrolled, fully attached except for *c.* 1–2 mm distal ligulate portion; blades dull to slightly glossy rich mid-green, not variegated, *c.* 25–40 cm long, 5–8 cm wide at widest point, oblanceolate, the base attenuate, the apex shortly acuminate and mucronate for *c.* 1.5–2 cm, the mucro solid; primary venation *c.* 6–8 per side, diverging at an angle of *c.* 35–45°, flush adaxially, barely prominent abaxially, interprimary veins irregularly present, secondary and tertiary venation inconspicuous and flush with the lamina; inflorescences several to *c.* 12 together, on very slender, wiry, suberect peduncles *c.* 12–25 cm long (elongating in fruit), nodding from the apex of the peduncle; spathe to *c.* 6 cm long including the *c.* 1 cm long mucro; lower spathe *c.* 2 cm long, narrowly ovoid, *c.* 0.8 cm diam. at anthesis, mid-green, separated from spathe limb by a rather weak constriction; limb narrowly lanceolate, clasping and slightly gaping at anthesis, then deliquescent-deciduous, pale yellowish green; spadix equalling laminar portion of spathe in length; female zone 1/3–1/2 the length of the spadix, adnate for *c.* 2/3 its length to the spathe, *c.* 5 mm thick; interpistillar staminodes few amongst the ovaries, mainly concentrated into a somewhat interrupted single ring at each of the base and apex of the female zone, slender-stalked, apically narrowly clavate, a little higher than the pistils; pistils globose, rather distant, *c.* 1 mm diam.; stigma punctate, sessile; male zone cylindric, *c.* 1 cm long, 5 mm thick; stamens close-packed, some with filaments partially united forming dimerous to trimerous male "flowers", others solitary; anthers ± dumbbell-shaped from above with the connective forming a slight dome between the thecae; thecae opening through apical slit-like pores; pollen dusty; appendix *c.* 1.5 cm long tapering-cylindric to very narrowly ovoid, *c.* 5mm thick at base, composed of very close-packed columnar flat-topped staminodes *c.* 0.7 mm diam.; fruiting spathe narrowly campanulate, nodding; fruit green.

DISTRIBUTION. Endemic to Peninsular Malaysia and known only from Perak, in lowland rain forest and lowland hill forest, and regrowth, sometimes near streams.

Other specimens seen:

**PENINSULAR MALAYSIA.** Perak, Tanjong Pondok, *Burkill & Hanif* 13246 (K, SING); Perak, Bukit Larut, *Hay et al.* 9063 (UPM & distr. ex cult. HRBS, 940159); Perak, foothills

of G. Bubu, *Hay et al.* 9125 (distr. ex cult. HRBS, 940121); Perak, Taiping Hill, *Henderson* 10253 (SING); Perak, Taiping, along rd to Maxwell's Hill, *Nicolson* 1069 (SING); Perak, Kuala Temangoh, *Ridley* 14307 (SING); Perak, G. Hijau, *Ridley s.n.* (SING); "Perak Hills", *Ridley s.n.* (K); Perak, Maxwell's Hill, *Ridley s.n.* (SING); Perak, Relau Tujor, *Wray* 1784 (CAL), 2193 (CAL, SING).

A very distinctive and morphologically uniform species easily recognized by the rather numerous nodding inflorescences on (for this genus) very long slender peduncles. Although it does sometimes grow along streams, it is by no means confined to that habitat and in spite of its rather narrowly lanceolate blades is not really a stenophyllous rheophyte. Although not ostensibly restricted to a specialized habitat, this species has proved extremely difficult to keep alive in cultivation.

According to Prain's note attached to the lectotype, material of this species was somehow overlooked when the aroids were being sent to Hooker for the Flora of British India account (Hooker, 1894). Prain proposed the name *S. rhynchopyle* owing to the resemblance (in the nodding inflorescence and narrow leaves) to species of what is now known as *Piptospatha* (syn. *Rhynchopyle*), but it was never published.

**Inadequately known species**

**8. Schismatoglottis penangensis** Engl. in Engl. & Krause, Pflanzenr. 55 (IV.23Da) (1912) 88. Type: Malaysia, Penang, 'Balch Poula' [?= Balik Pulau], *Deschamps s.n.* (CAL, holo, not found).

Translated from the Latin, Engler's description reads: "Stem hypogeal; petiole equalling to exceeding half the length of the blade, 8–12 cm long, channelled adaxially, sheathing for 2–3 cm; blade oblong-lanceolate, subequally narrowed on each side, the base running cuneate into the petiole, the apex acuminate; primary veins 4 on each side diverging at *c.* 30° and curving distally, distinctly prominent abaxially; peduncle of infructescence shorter than petiole, 10 cm long; fruiting spathe 2 cm long, 1.5 cm wide, cup-shaped."

Known only from the type.

From the protologue, it is evident that this species is imperfectly known; I have looked for the type at CAL where it was said by Engler (*loc. cit.*) to be, but was unable to find it in either the Type or the General Herbarium. The hypogeal stem and oblong lanceolate blade with cuneate base suggest *S. wallichii* but it differs from that in the rather short cup-shaped fruiting spathe.

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